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ABSTRACT

Sex differences in reading achievement and growth patterns in a sample of students from grades 4 through 8 were determined in a longitudinal study. All 263 eighth graders at Crossroads Junior High School in South Brunswick, New Jersey, in the 1968-69 school year were tested, but only those students who had been enrolled for the 5-year period took part in the longitudinal study. The Iowa Test of Basic Skills, the California Reading Test, and an informal cloze test were the measuring devices. There were no significant differences in the mean test scores at each grade level, and no significant trends were noted. Although girls and boys had similar average annual reading growth rates, the latter grew more sporadically. Product-moment correlations between tests showed the boys to be more consistent than the girls. Significant differences in reading ability existed between students in South Brunswick from grades 4 through 8 and those who moved into the community. The boys who entered after the beginning of grade 4 were significantly inferior in reading to the students already there. The cloze test did not consistently correlate highly with the two standardized tests given in grade 8. Further research is recommended. A bibliography and appendixes are included. (Author/CL)

A LONGITUDINAL STUDY OF SEX DIFFERENCES IN READING ACHIEVEMENT IN GRADES FOUR THROUGH EIGHT

A THESIS

SUBMITTED TO THE FACULTY

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ABSTRACT

The purpose of this longitudinal study was to determine sex differences in reading achievement and growth patterns in a sample of students studied from fourth grade through eighth grade. The Iowa Tests of Basic Skills, the California Reading Test, and an informal cloze test were used as measuring devices.

All 263 eighth grade students at Crossroads Junior High School in South Brunswick, New Jersey, in the 1968-69 school year participated in this study. Only those students who were in South Brunswick for the five-year period took part in the actual longitudinal study.

The questions asked were:

1. How do the reading abilities of boys and girls compare in grades four through eight?
2. What are the relative annual growth rates of the same boys and girls over the same period of time?
3. How does a class's performance on one test correlate with its performance on other tests in the same and different years? Are these correlations different for boys than for girls?
4. Are there differences in reading ability between the students who were in South Brunswick from fourth grade through eighth grade and

those students who gradually moved into the community? Are sex differences present?

5. How does the cloze test correlate with the two eighth grade standardized reading tests?

There were no significant sex differences in the longitudinal study between the mean test scores at each grade level, and no evidence of any trends.

The girls and boys had similar average annual growth rates, but the boys were more sporadic. They displayed a drop in fifth grade achievement, which was compensated for in fourth grade and sixth grade, so that the boys were always near grade level. The girls consistently made about a year's growth in reading each year.

The boys were more consistent in their testing, having an average correlation coefficient of .74. The girls' average correlation coefficient was .64. The girls had a wider range in correlations, dipping as low as .30.

Significant differences in reading ability existed between the students in South Brunswick from fourth grade through eighth grade and those students gradually moving into the community. The boys entering later were significantly inferior in reading to the boys already in South Brunswick, and also inferior to the girls entering the township.

The cloze test did not consistently correlate

highly with the two standardized reading tests given in eighth grade. The cloze test correlated better with the Iowa Tests of Basic Skills than the California Reading Test. It is possible that the comprehension sections on these two tests are not measuring the same thing.

A glance at the recent history of the South Brunswick School System reveals some possible factors which might have contributed to the elimination of sex differences in its elementary schools. The school system has strongly encouraged individualization of instruction and the multi-text approach. Early remediation is provided for many students who need it and severe reading disabilities are usually placed in special classes.

The question of whether or not girls have an inherent advantage in learning to read or whether this advantage has been built into our school systems has not been answered. The fact remains that in some schools sex differences are not evident. This fact should provide the needed incentive for further research into the reading development of boys and girls.

ACKNOWLEDGMENTS

Grateful appreciation is extended to Dr. Edward Fry for his guidance and encouragement from the inception of this study. Dr. John Geyer and Dr. Phillip Shew are to be thanked for their help as members of my advisory committee. I am indebted to Mr. Joseph Zelnick for his advice and his assistance with the actual testing, and also to Mr. Fred Nadler, principal of Crossroads School, South Brunswick, New Jersey. My husband, James Dakin, is also to be thanked for his invaluable assistance, particularly with the statistical aspect of my study.

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CHAPTER 1

INTRODUCTION

Sex differences in reading ability have been a source of concern to educators, researchers, and administrators for many years. Ayres (1909), in his book Laggards in Our Schools, concluded: "Our schools as they now exist are better fitted to the needs and natures of the girl than the boy pupils" (p. 155).

Weintraub (1966) pointed out the deep concern of educators today with the high proportion of poor students, repeaters, and dropouts among boys. After reviewing research concerning sex differences, he made this summarizing statement: "Beyond the first grade, the evidence is somewhat similar in that, as a rule, girls maintain their superiority in reading achievement at least through the elementary grades" (p. 159).

Stroud and Lindquist (1942) collected data on sex differences in achievement using 50,000 pupils in elementary school and high school as subjects. They found girls consistently better in reading right on up to the high school level. While the sex differences at the high school level were not significant, they did favor girls.

The majority of the research done indicated that girls do hold the advantage, as far as reading is concerned, on the elementary level. Far less research has been done on the secondary level, and this research has produced conflicting results. For a better understanding of the relative reading development of boys and girls, a longitudinal study is the most direct approach.

Statement of the Problem

If girls are superior to boys in reading ability in the early primary grades, when do boys start catching up to girls? Is this catching up process a gradual, consistent one, or do boys make uneven gains, with some grades being more influential than others? The purpose of this longitudinal study was to determine whether sex differences in reading achievement exist, from fourth grade through eighth grade, using standardized tests and an informal cloze test as measuring devices.

The questions asked were:

1. How do the reading abilities of boys and girls compare in grades four through eight?
2. What are the relative annual growth rates of the same boys and girls over the same period of time?
3. How does a class's performance on one test correlate with its performance on other tests in

the same and different years? Are these correlations different for boys than for girls?

4. Are there differences in reading ability between the students who were in South Brunswick from fourth grade through eighth grade and those students who gradually moved into the community? Are sex differences present?
5. How does the cloze test correlate with the two eighth grade standardized reading tests?

Population

All 263 eighth grade students at the Crossroads Junior High School (grades six through eight) participated in this study. This is the only junior high school serving the South Brunswick, New Jersey, community, and draws students from the following towns: Deans, Dayton, Monmouth Junction, Kingston, and Kendall Park.

South Brunswick is a low-middle to middle income community of about 14,000 to 16,000 people. The scope covered occupationally by the parents of students in this community is very large: civil service workers, owners of small businesses, college professors, farmers and migrant workers, engineers, scientists, businessmen, teachers, and manual workers. Of the 26,500 acres in the township, about 50 percent is used for agricultural purposes or is vacant land. Included in the 60 industrial buildings are

International Business Machines Corporation, Radio Corporation of America, and the Wall Street Journal.

The school population at the time of the study was approximately 3,800 and the township was spending a little over $1,000 per child per year on education. The township prides itself on having an innovative and progressive school system.

Crossroads is an ungraded junior high school, organized on a unit basis, with about 100 students in each unit. There are sixth, seventh, and eighth grade students together in some of the units and just seventh and eighth graders together in other units. Each unit has an English, science, mathematics, and social studies teacher. The overall philosophy of the school emphasizes individualization of instruction. Of the 263 students who participated in this study, approximately half were boys and half were girls. The students had spent one full year and four months of their second year at Crossroads, at the time of the eighth grade testing. They entered the school as seventh graders, the first year Crossroads was open. Prior to coming to Crossroads, each student was in one of the six elementary schools in the township, some having experienced the ungraded organization in their elementary school, as well.

Procedure

There were three tests used in this study. The first test was the Iowa Tests of Basic Skills, for which many eighth graders had annual scores going back to fourth grade. The other two tests, the California Reading Test and a cloze test, were administered to the eighth grade class. The analysis consisted of separating the boys from the girls and comparing their performances on the tests. In addition to comparing reading abilities and growth rates, the author studied correlations between the various tests.

For the past five years the South Brunswick School System has administered the Iowa Tests of Basic Skills to all students in grades four through nine. The testing took place in the early part of each new school year. The eighth grade subjects in this study had reading scores from these tests going back to fourth grade. Because of new students entering the South Brunswick School System, and because of incomplete records, scores going back to fourth grade were not available for all the eighth grade students. Only those students who had scores going back to fourth grade were included in the longitudinal study. The scores for the remaining children were compared to the scores of the children in the longitudinal study.

The California Reading Test, Junior High Level

(7-8-9), was administered to all of the eighth grade students, to either reinforce or contradict the results of the Iowa Tests of Basic Skills. Specifically, Form W of the 1957 edition was given in January of the 1968-69 school year.

An informal cloze test was also administered to all of the eighth grade students. The cloze test's purpose was twofold--to provide a third, independent, and unstandardized measure of the boys' and girls' relative reading skill, and to measure the correlation between its and the standardized tests' scores for the same individuals.

In total, thirteen scores were used in the study: the Iowa Reading Vocabulary and Reading Comprehension scores for each of the five years, the California Reading Vocabulary and Reading Comprehension scores for eighth grade, and the raw scores for the cloze test. The California Reading Test and the cloze test were administered within one week of each other in early January, about ten weeks after the Iowa Tests of Basic Skills was administered to the eighth graders.

Importance of the Study

Sex differences in reading achievement have been the subject of a great deal of research. However, the overwhelming majority of the research has not been of a

longitudinal nature. Rather than relying on different samples of students to represent each level of reading development, the longitudinal study follows the same sample of students through all levels. It is thus an inherently more reliable tool for studying unfolding growth patterns.

The results of the present study can prove to be very meaningful to educators and administrators in South Brunswick. From these results certain implications for elementary as well as high school reading instruction might be made concerning such things as curriculum planning, grouping, and materials.

Limitations

Recent intelligence test scores for all of the students taking part in the study were not available. It is not within the general policy of the South Brunswick School System to administer intelligence tests, except in special cases when children had been referred by teachers for psychological testing or remedial work.

Several people over many years were involved in administering the tests reported here, which made it difficult to determine if the testing situations were as uniform as possible.

Also, the possibility of error existed in hand scoring and in copying data from the cumulative folders

and then punching the results onto computer cards.

Unfortunately, the limited sample of this study was detrimental in two ways. First, because of the small numbers involved, statistically significant trends were hard to discern; and second, because the study involved only one school in one community, broad generalizations could not be made.

CHAPTER II

REVIEW OF RELATED RESEARCH

Research on sex differences in reading ability has dated back as far as the early 1900's with much research done since then. There are still differences of opinion as to whether or not sex differences are inherent, due to physiological factors, or whether the cultural, environmental factors are more influential. Another question that remains unresolved is, if a sex gap exists, when do boys bridge the gap? These questions are explored in the subsequent review of literature.

Early Research

Ayres (1909) concluded that schools met the needs of girls better than boys after analyzing the records of several hundred thousand pupils in various cities of the nation. In the elementary schools of 15 cities, with a total population of 282,179 pupils, he found retardation among 37.1 percent of the boys and 32.8 percent of the girls. Also, 23 percent of the boys were repeating grades as compared with 20.2 percent of the girls. He felt the schools were overly female oriented, which might have caused the difference.

St. John (1932) carried out a study involving 1,000 students in grades one to four. It was concerned with sex differences within similar I.Q. groups for repeating and skipping grades. He reported that boys showed 7 percent more repeating of grades than girls did. A higher correlation was found between I.Q. and achievement for girls than boys.

> The consistent inferiority of the boys in school progress and achievement is due chiefly to a maladjustment between the boys and their teachers, which is the result of interests, attitudes, habits and general behavior tendencies of boys to which the teachers fail to adjust themselves and their school procedures as well as they do to the personality traits of girls [pp. 659-72].

He stated that girls would excel less if school achievement were measured by standard tests and not teacher marks.

Konski (1951) studied the performance of boys and girls on reading readiness tests and then tested them at the end of first grade. She found boys and girls equally ready to start reading instruction. However, the girls performed significantly better on a reading test administered at the end of first grade.

At the University of Michigan Laboratory School, a study (Anderson, Hughes, & Dixon, 1956) was carried out to determine sex differences in the chronological age of learning to read. On the average, girls learned to read more than six months earlier than boys, and there were

fewer extreme delays among girls.

In a second study, Anderson, Hughes, and Dixon (1957) concluded that after children reached a reading age of 84 months on the Gates Primary Reading Test, there was no difference between the boys' and girls' rates of advancement. Sex differences in the age of learning to read tended to disappear among children of high intelligence, whereas in the lower intelligence group, boys started later than girls.

Lincoln (1927) found that girls on the elementary level tended to excel in reading by small margins. He summarized the findings up to that time as follows: (1) girls are consistently better in arithmetic computation, boys are slightly better in arithmetic reasoning; (2) girls are somewhat better in reading rate, spelling, and handwriting, and (3) boys are better in history, geography, and geometry.

Commins (1928) obtained a non-significant difference in the fifth grade in favor of girls on the reading tests of the Stanford Achievement Battery. Her study involved 85 boys and 90 girls, and the results of the entire battery agreed with those of Lincoln (1927).

In an important study carried out by Stroud and Lindquist (1942), data were collected on sex differences in school achievement. Over 300 schools and 50,000

pupils were the source of the data.

> In the Iowa Every-Pupil Basic Skills Testing Program (for grades III-VIII), girls maintained a consistent and, on the whole, significant superiority over boys in the subjects tested, save in arithmetic, where small, insignificant differences favor boys. These findings corroborate previous investigations in both these respects. On the other hand, in the Iowa Every-Pupil High School Testing Program the advantages just as definitely have gone to the boys, two exceptions being in algebra and reading comprehension, where small and on the whole not significant differences favor the girls [pp. 665-66].

Stroud and Lindquist attributed the shift in sex superiority to a change in curriculum from elementary school to high school.

Hughes (1953) tested boys and girls in grades one through eight, using the Chicago Reading Tests. She found the greatest difference in grade three, where the girls achieved more than a half school year above the boys. This difference favoring girls was significant at the 1 percent level. The difference was significant at the 5 percent level in grade four. In grades five to eight, girls made higher scores, but the differences were not statistically significant.

In another study (Alden, Sullivan & Durrell, 1941-42) over 6,000 students were tested in grades two through six with the Durrell Sullivan Reading Capacity Test. The number of boys who were one or more years retarded in reading was double that of girls in each of the first five grades.

Jackson (1944) selected 300 advanced readers and 300 retarded readers in grades two through six. He wanted to determine whether these two groups of students differed on the basis of psychological, social, and environmental factors. He found a disproportionately high number of girls in the advanced group (59 percent) and a disproportionately high number of boys in the retarded group (63.3 percent).

The following three studies are all high school studies on some aspect of reading, and none of them revealed any sex differences. In a study involving 19,000 high school seniors in North Carolina (11,000 girls; 8,000 boys), Jordan (1937) found very few sex differences in the reading and literature scores of the subjects. The measuring device was a two-hour examination consisting of questions on reading, literature, English usage, history, science, and mathematics. Traxler (1935) and Moore (1940) found no significant sex differences in the rate of reading on the high school level.

Recent Research

Some evidence collected at the end of first grade showed that there were little or no sex differences in reading achievement (Miller, 1966). Others participating in the U.S. Office of Education first grade studies also concluded there were no sex differences in reading

achievement (Sheldon & Lashinger, 1966; Fry, 1966; Spencer, 1966; Manning, 1966). However, some participants in the first grade studies did find achievement favoring girls (Hahn, 1966; Schneyer, 1966; Spache, Andres, Curtis, Rowland, & Fields, 1966; Tanyzer & Alpert, 1966).

Wozencraft (1963) selected approximately 10 percent of all pupils in grades 3A and 6A from the records of all pupils in Cleveland, Ohio. The sex differences consistently favored the girls, often significantly. She concluded that sex differences were less marked in the high and low intelligence group at grade 3A, agreeing with the previously mentioned study (Anderson et al., 1957).

McNeil (1964) tested the hypothesis that teachers treat boys differently than girls, which is related to performance in beginning reading. Two methods were used to teach 40 words to kindergarten students. After four months of instruction, either by a female instructor or by an auto-instructional approach, the children were tested. The girls were superior in reading when taught by the female teacher. However, the boys were superior when auto-instructional techniques were employed. When McNeil asked the children to name the children who received the most negative comments from the teacher in the reading group, as well as the children who were given

fewer opportunities to read, boys were mentioned more frequently than girls in both cases. Teachers in the study claimed that the boys were not as ready as the girls to learn to read, nor as motivated. McNeil felt that this inferior handling of boys may be one factor which causes boys to be poorer readers.

In the Los Angeles City Schools, a research project was undertaken by Stanchfield over the 1962-63 school year. The purpose of Stanchfield's study was to determine whether boys' achievement in beginning reading would be affected by grouping in which groups were composed entirely of boys. There were 550 first grade children who took part in the study. The statistical analysis of reading achievement and growth indicated that there was no statistically significant difference between the boys taught alone and those taught in heterogeneous sex groupings. The girls, as a group, achieved significantly more than the boys.

> It appeared that during the first year of learning to read, the gap between the boys and girls had widened considerably. The analysis of the data demonstrated conclusively that the girls not only achieve more by the end of the first grade, but that girls acvually have greater growth in reading during the highly important first grade [Stanchfield, 1965, p. 291].

The teachers in the study admitted in a series of individual interviews that they had found basic differences between the learning behavior of boys and girls.

These differences fell into the following seven areas:

1. Activity Levels. Boys are much more active, energetic, and fidgety.
2. Verbal Facility. Boys were not as fluent in their speech, having more difficulty speaking clearly and easily.
3. Auditory Discrimination. Boys had more trouble making auditory discriminations and hearing common phonetic elements.
4. Listening Skills. Boys did not listen as carefully or intently as girls. But, the boys listened more effectively when keenly interested, and when the teacher used more than one of the five senses.
5. Attention Span. Generally, the boys' attention span was shorter than the girls', varying between 12-15 minutes, whereas the girls varied from 20-25 minutes.
6. Goals and Motivation. "Generally, the boys in the study were less anxious to please the teacher, less motivated to develop good work habits, less desirous of assuming responsibility, and less self-motivated in learning to read" (Stanchfield, 1965, p. 292).
7. Interests. It was hard to interest the boys

in subject matter that was not dynamic and unusual. Girls were easier to keep interested since their interests cover a wider scope.

The second year of the study concerned itself with materials used to teach beginning reading: pre-primers and first grade readers. Materials especially written to capture the interest of boys were used with experimental groups of girls and boys to see the effect on boys' reading achievement. The control groups used the basal series adopted by the State of California. The boys in the experimental groups achieved more in reading than the boys in the control groups, but not to a significant degree.

The third year of research, 1964-65, continued with the analysis of factors affecting boys' achievement in beginning reading. The teachers continued using the high interest, adventure stories, as well as a variety of materials developed in the summer of 1964. The following two school years, 1965-67, the author developed and tested with significant results a set of basal readers, with imaginative, lively stories geared to the interests of boys. Since then, Stanchfield has developed reading readiness materials and other materials to be used as reinforcers for the child who has difficulty in learning to read.

In a study by Sinks and Powell (1965) covering

grades four to eight, the author found significant differences in grades four and five, favoring the girls. However, in grades six to eight, the pattern varied. These findings are in agreement with the previously mentioned studies of Hughes (1953) and Stroud and Lindquist (1942).

Harris (1961) claimed that from birth on there are detectable sex differences in physiological maturity. Girls reach puberty one and a half years earlier than boys. They talk somewhat earlier than boys, have larger vocabularies, and talk more than boys. During preschool years boys spend more time on large-muscle activities and girls spend more time on sedentary activities which often help develop good close vision and fine manual skills, such as sewing and doll play.

> When we note that boys constitute about two-thirds of the milder reading disability cases and make up 75 to 90 percent of the severe cases, it is easy to infer that more boys than girls are not ready for reading instruction when they enter school (pp. 27-28).

Preston's study (1962) supported the environmental explanation of sex differences in attitudes and achievement in reading. He compared the reading achievement of German and American children and found that unlike the American pattern, German boys read better than German girls. Preston points out that the majority of teachers in Germany are male, which may suggest more of an emphasis in the German culture on reading as a masculine activity.

Gates (1961) carried out a very large study using 13,114 pupils in grades 2 to 8 to determine sex differences in reading ability. There were 12 school systems in 10 states that participated in the study. Boys and girls in each of the seven grades were compared on reading speed, vocabulary, and comprehension. In each of the 21 comparisons, girls had higher mean raw scores, and most of the differences were significant.

> The usual explanation for the girls' superiority in reading is that they mature earlier. The explanation seems unlikely, for the superiority of the girls appears to be, on the whole, as great in the upper grades as in the lower. . . . The distribution of scores on tests of reading ability shows that a relatively large proportion of boys obtained the lowest scores without a corresponding increase in the number obtaining top scores. The present data suggest an environmental rather than a heredity explanation [p. 432].

In another study (Parsley, Powell, O'Connor, & Deutsch, 1963) the California Reading Achievement Test, the California Arithmetic Test, and the California Test of Mental Maturity were used to determine if sex differences really exist in achievement. When the differences between the sexes failed to approach significance and were, in fact, very small, the authors contacted the California Testing Bureau to see if the measuring instruments were constructed to control for sex differences. The authors were assured that the California tests should show sex differences if any existed. The sample for this

study consisted of 2,651 boys and 2,369 girls in grades two through eight.

The authors then carried out a further investigation into the presence of sex differences in achievement as related to I.Q. in grades four through eight. The California Test of Mental Maturity was again used, as was the California Achievement Test Battery. The sample totaled 3,551 pupils, and generally was very similar to the previous sample. However, this time sex differences in achievement showed up. Even when the differences were not significant statistically, the differences generally favored the girls. The authors suggested that too much emphasis has been placed on sex differences without careful consideration of the part scores of the test.

> If student placement and instructional levels are to be based on achievement test results, careful consideration should be given to the student's intelligence level, his achievement level, and particularly to the part scores of the test [Parsley et al., 1964, p. 269].

Davis (1966) found no significant sex differences in any grade in the ability of fourth, fifth, and sixth grade pupils to distinguish between statements of fact and opinion.

Ruddell (1966) studied the language patterns of fourth grade children to determine the effect of children's oral and written language patterns on reading comprehension using passages similar to their oral language

structure.

> Reading comprehension was found to be a function of the similarity of oral patterns of language structure to written patterns of language structure used in reading materials. . . . The fathers' occupational status, parents' educational background, and subjects' intelligence, mental age, and chronological age were significantly related to reading comprehension of the materials utilizing high and low frequency patterns of oral language structure. . . . Sex differences were not significantly related to reading comprehension (p. 392).

In a junior high school study (grades seven to nine), carried out by Nasman (1966), the long- and short-term growth of a six-week reading improvement program were analyzed. No significant differences showed up when sex comparisons were made.

Turner (1966) evaluated the intensive use of the SRA (Science Research Association) Reading Laboratory IIa with seventh grades for its effect on reading achievement. No sex differences were found in reading achievement gain over the pretest to posttest period. In direct opposition to this study, Summers (1967) evaluated a seventh grade developmental reading program. The author made several conclusions, including the following: (1) in almost every comparison analyzed, the females made significantly greater gains than the males; and (2) almost a complete lack of significant interaction existed between scheduling, intellectual ability, and sex.

Heilman (1961) reviewed numerous studies on sex

differences in reading achievement and made the following summarizing statements:

1. Boys as a group are surpassed by girls as a group in reading achievement in grades one, two and three.
2. The superiority in reading ability of girls tends to diminish during the intermediate grades [p. 353].

Possible Causal Factors

The evidence seems to indicate that sex differences exist in reading achievement, but it is difficult to say what causes these differences. Several hypotheses have appeared which suggest possible causal factors.

Heilman (1961, pp. 358-59) presents some of these factors in his book Principles and Practices of Teaching Reading:

1. Boys and girls at certain ages differ in "intelligence." (This issue will probably have to go unresolved at the present because, as Terman points out, contemporary tests of intelligence are not constructed so as to point up differences.)
2. Boys and girls mature at different rates and some phases of growth are closely related to reading.
3. The school environment and curriculum at the primary level are more frustrating to boys than to girls.
4. Basal reader materials are less motivating and satisfying to boys than to girls.
5. Most primary teachers are women.
6. Boys are less motivated to learn to read.

Weintraub (1966) claimed that causal problems are very complex and involve cultural, environmental, and maturational factors. The research done in this area confirmed Weintraub's hypothesis. Preston's study (1962),

which compared American and German children, reinforced the cultural influence upon reading. Environmental influences were emphasized in McNeil's study (1964), which pointed out the subtle differences in the treatment of boys and girls by teachers. Two studies in particular stressed maturational factors. Anderson et al. (1956) found that the girls learned to read more than six months earlier than the boys did and with fewer extreme delays. McCarthy (1954) stated that girls were statistically superior in langugage usage and facility in preschool and primary years which helped to develop a firm foundation for learning to read.

The general trend appeared to be that sex differences in reading achievement, favoring girls, were the greatest in the primary grades. The gap gradually became smaller and smaller as children approached high school. Stroud and Lindquist (1942) found non-significant differences in reading, favoring girls, on the high school level. However, the boys had generally become superior to girls when considering the rest of the high school curriculum. The authors explained this shift as a result of a change in curriculum.

> With the exception of language usage and allied subjects, the subjects in which girls show their greatest superiority are not found among formally organized subjects of high school curricula. On the other hand, those subjects in which boys appear to

> excel in the elementary school, the sciences and the social sciences, loom relatively large in high school curricula. Unfortunately, the data at hand are too meager to permit any very positive statement about male superiority in the sciences and social sciences at the elementary level. In the two subjects that run through both the elementary and high school with respect to which we do have ample data--reading and language usage--we find the two sexes maintaining the same relative positions throughout [p. 666].

Possible Solutions

If educators are aware of sex differences and have suggested possible causal factors, the question now should be: What can be done about sex differences in reading achievement?

It has often been suggested having boys start school later than girls because physiological maturity of boys often lags a full year behind girls. Girls are superior to boys in skeleton development throughout the preschool period. Because boys are less physically mature than girls, their eye muscles may not be ready for the task of beginning reading. However, having boys start school later than girls overlooks the problem of individual variability in readiness. Smith and Dechant (1961) suggested that "the solution lies in a delay of formal reading instruction until the child is ready for it and in an early provision of experiences that will prepare him for reading" (p. 95).

Heilman (1966) suggested an in-service program for

teachers to sensitize them to sex differences and to cultivate an awareness of the importance for providing for individual differences.

Preston's study (1962) pointed out the need for more men teachers on the elementary level in order to "masculinize" the school situation.

Flaherty and Anderson (1966) claimed that the story content of most basal-readers is more interesting to girls than to boys.

> Girls are more motivated by the type of home and community stories found in the basal-readers whereas boys' interests reach out to the mechanical things such as aviation, space, and missiles. Much needs to be done in the writing of books to include topics which interest boys [p. 472].

Sister Mary Nila (1953) stated that girls are more likely to work up to their abilities because they are more motivated, and motivation in her eyes determines progress in learning to read. A variety of books and instructional materials of interest to both boys and girls and wise grouping within the classroom should cultivate a more stimulating atmosphere for boys.

Organizational and administrational innovations, such as the ungraded primary, the ungraded elementary school, and team teaching are ways to help provide for individual differences.

A greater emphasis on psychological assessment was recommended by Heilman (1961). He pointed out that five

times as many boys as girls are referred to clinics due to academic or behavioral problems. He suggested that boys as a group would benefit considerably from earlier diagnosis and guidance.

Weintraub (1966, p. 163) concludes, "We do know that boys vary widely among themselves as do girls. The only effective answer, then, must be to be aware of and to provide for these individual differences."

It is apparent that a multiplicity of factors are responsible for the disparity between girls' and boys' reading ability. Additional research is necessary to test the various solutions that have been offered. Only then can constructive steps be taken towards optimally educating both boys and girls.

CHAPTER III

PROCEDURES

The progress of this study can be broken into three steps: choosing the tests, obtaining students' scores for these tests, and computing test score statistics for each of several samples of students. In the first step the students were chosen. Because the South Brunswick School System had been administering the Iowa Tests of Basic Skills for many years, many students had available scores on this test dating back to fourth grade. The Iowa Tests of Basic Skills therefore provided an excellent basis for the longitudinal study. Two additional tests were administered to the students in eighth grade specifically for the present study--the California Reading Test and an informal cloze test. They provided, respectively, a standardized and unstandardized consistency check on the results of the eighth grade testing.

As the Iowa Tests of Basic Skills had been administered by the school system, each student's results on this test had only to be copied from his records for as many years as he had been in South Brunswick. The

experimenter had to design the cloze test and arrange for the administration of both it and the California Reading Test. For each student in the study a computer card was prepared containing all available scores.

Finally, a computer program was prepared to read samples of these cards and from them compute mean test scores, standard deviations, and product-moment correlation coefficients. The statistics of the four samples were then compared.

Selection of Tests

California Reading Test. As mentioned, the California Reading Test was administered. Form W of the 1957 edition of the Junior High School Level (7-8-9) with 1963 norms was used. The test is a separate printing of the reading test contained in the battery booklet of the CAT (California Achievement Tests), and was written by Ernest W. Tiegs and Willis W. Clark. The Reading Vocabulary section has been divided into four subtests, each having 15 items: Mathematics, Science, Social Science, and General. These four subtests yield a Total Vocabulary score. The Reading Comprehension section has been divided into three subtests: Following Directions (15 items), Reference Skills (26 items), and Interpretations (45 items). These subtests yield a Total Comprehension score. The Total Vocabulary score and the Total Comprehension score

together yield a Total Reading score. The test is administered in one sitting and takes 68 minutes.

In 1963 the publisher compiled new norms. Interestingly, with the exception of the junior high level reading test, the contents of the achievement test itself were not revised at all from the 1957 edition. The California Achievement Tests, in general, received favorable reviews in The Sixth Mental Measurements Yearbook, with the exception of somewhat limited coverage. The tests for the recent norming were administered to 15,000 students, the number ranging from 968 to 1,481 per grade level.

In the Technical Report on the California Achievement Tests, several types of reliability coefficients are given. The Kuder-Richardson formula #21 was used to compute the reliability coefficient for internal consistency. No corrections or adjustments were made. One grade group from a single school system was used for each level of the test. The raw scores of 200 subjects at grade 8.1 were used to compute the coefficients: Reading Vocabulary .90, Reading Comprehension .92, and Total Reading .95.

The cloze test. The cloze test was used in this study to determine whether sex differences were present in an unstandardized test. It was also felt that with the developing interest in the cloze technique, it would be

interesting to see how the cloze correlated with the other two standardized reading tests.

Bormuth and MacDonald (1965) discovered that scores on cloze tests correlated with scores on tests of ability to detect an author's style. Subjects appear to be as influenced by an author's style when reading material within a cloze test as when studying a book by the same author. Cloze tests were as valid when students had never read the test materials as when the subjects had studied those materials.

Bormuth (1963) concluded that cloze tests were valid, reliable, and flexible measures of the comprehension difficulties of the reading selections from which the cloze tests were made. They were also valid and uniform measures of reading comprehension ability which were appropriate for use with individuals and groups that vary widely in comprehension ability.

A similar study carried out by Taylor (1953) concluded that the cloze test which permitted any word to be deleted, the simplest form of cloze test, yielded more stable, reliable, and discriminating results than the other two types of cloze tests which required specific types of words deleted.

According to John R. Bormuth (1969), much of the research done in the area of cloze tests indicates that

there is a high correlation between scores on cloze tests and scores on standardized tests of reading comprehension. He referred to Jenkinson (1957), Ruddell (1966), and his own study (1965) which disclosed correlations ranging from .70 to approximately .85.

Cloze tests can be made in a variety of ways. For the purpose of this study, every fifth word of a particular reading selection was deleted. The deleted words were replaced with an underlined blank of a specific length. Bormuth (1969) claimed that "the most valid and economical results are obtained by scoring correct only those responses exactly matching the deleted words" (p. 360), using his own study in 1955 and Rankin's study in 1957 as references. Therefore, in correcting the cloze test, only the exact response matching the deleted word was acceptable.

A reading selection entitled "What Do You Know About Snow?" by George Barmann appeared in Popular Science in January 1961. This selection was revised by John H. Coleman and Ann Jungeblut and used in their eighth grade Reading for Meaning workbook. Almost in its entirety, the revised selection was used for the cloze test. This particular selection was chosen because it was one of three selections out of 32 in the eighth grade Reading for Meaning workbook which revealed no sex differences on

like-dislike ratings. (An average of 194 ratings were used per selection for this rating in the eighth grade workbook.) According to Fry's Readability Formula (1968), this selection is on a seventh grade reading level. The directions for administering the cloze test and the test itself are in Appendix A.

The Iowa Tests of Basic Skills. The entire battery of the Iowa Tests of Basic Skills is given to each South Brunswick student beginning in fourth grade. Therefore, test scores were available for a possible five-year period for students that had been in South Brunswick from fourth to eighth grade. Other students only had those scores included from the time they moved into South Brunswick. The scores used from the Iowa Battery were the Reading Vocabulary and the Reading Comprehension scores.

The vocabulary test is the first test in the Iowa Battery, followed by the comprehension test. Virgil E. Herrick, reviewing the battery in The Fifth Mental Measurements Yearbook of Oscar Krisen Buros, states:

> The stimulus words (in the vocabulary test) are selected from the Thorndike and Rinsland lists, as are the words in most other vocabulary achievement tests. . . . While limited, this sample still is more adequate than that employed in many similar tests. . . . The most important criticism in regard to the testing of vocabulary is that major attention is paid to understanding the meanings of words while little attention is given to the evaluation of tools involved in word recognition and verification. . . .
>
> Most of the items (in the comprehension test) for

> grades 3, 4, and 5 deal with comprehension of details; the test section for 6, 7, 8, and 9 includes increasing numbers of purpose, organization, and evaluation items. One question which might be considered is why better balance in the different types of comprehension items is not maintained at all grade levels. . . . In defense of the large number of items dealing with details, it should be said that most items go beyond recognition of facts to understanding and drawing inferences from the reading selections [pp. 32-33].

The reliability coefficients are quite high, as often expected with a long test. According to Herrick, they range from .84-.96 for the major tests and .70-.93 for the subtests.

A letter from the Houghton Mifflin Company confirmed the fact that their test, The Iowa Tests of Basic Skills, does not discriminate between the sexes. It measures only the pupil's ability to put to use his acquired skills in each of the subtests.

Testing Procedure

For the California Reading Test the eighth graders were tested by unit. The guidance counselor and reading specialist at Crossroads School each tested a unit. The other four units were tested by the author. The testing procedures described in the Teacher's Manual were closely adhered to. Makeup tests were not provided for those students who missed the test due to the complexity of scheduling. In total, 229 students were administered the California Reading Test. The test, according to the California

Test Bureau, was not constructed to control sex differences (Parsley et al., 1964).

The English teacher from each unit administered the cloze test, with the exception of Unit III, where the investigator, the social studies teacher for that unit, gave the test. Identical instructions were given to each teacher to follow in administering the test. The instructions and the cloze test itself are found in Appendix A. The cloze test was completed by 225 students.

Treatment of Results

The scores from the Iowa Tests of Basic Skills were machine scored and the results entered into the cumulative folders by teachers. The Reading Vocabulary and Reading Comprehension scores from this battery were copied onto data sheets for each child.

The California Reading Tests were hand scored, using Scoreze #540. The cloze tests were also hand scored, using a template. These scores were combined with the Iowa scores on each child's data sheet.

For each child included in the study, a computer card was prepared containing his name, sex, present unit number at Crossroads, and the results of each of the 13 tests. If a child had no score available for a specific test, a zero was entered in that test's column on the student's card.

Statistical Design

Because the study was longitudinal, the students of primary interest were those whose complete test score histories were available for grades four through eight. These students, the ones in samples 1 and 2, comprised the main study. There were many additional students who entered the South Brunswick School System after fourth grade. Because of their diverse histories and incomplete records, they could not be included in the longitudinal study. They did, however, provide substantial additional data which could not be ignored. They were included as samples 3 and 4.

The cards were sorted into four separate samples:

1. Boys having scores from fourth to eighth grade
2. Girls having scores from fourth to eighth grade
3. Boys entering after fourth grade
4. Girls entering after fourth grade

The statistics of each of these four samples were computed by the subroutine MISR, taken without modification from the IBM Scientific Subroutine Package. MISR takes the many observations, one per child, of the 13 variables, and computes the mean, standard deviation, and number of observations for each variable. The missing scores, identified by 0's, are skipped over and not counted by MISR. MISR further computes the product-moment correlation coefficient for each pair of variables. Several additional statistics are calculated

but not used in this study. A description of MISR can be found in the Scientific Subroutine Package Manual (1968).

In order to use MISR, a simple input-output program named KARSY was written by James Dakin, a Princeton University graduate student. It read the cards into the IBM 360/91, arranged the scores in arrays suitable for MISR, called MISR, and then printed out the results of MISR's computations. KARSY also made histograms of the scores of each of the 13 tests. These histograms were examined visually to look for any gross abnormalities in the distributions. Appendix B contains a listing of KARSY. The principal output for each of the four samples is found in Appendix C.

A second, simple program was used in comparing the performances of the four samples on each of the 13 tests. For each comparison, it computed the Z statistic and the difference of the means, given the means, standard deviations, and N's of the two samples being compared on a specific test. These Z statistics were then examined to see which samples differed significantly, on which tests, and to what level of significance.

CHAPTER IV

RESULTS

The results of this study do not support most of the studies previously mentioned in the Review of Literature. The general reading ability of the boys and girls in the longitudinal study did not differ significantly. However, other sex differences were evident.

Four population samples were used in the study. The N for each of these samples is given in Table 1. Hereafter the samples will be referred to frequently as sample 1, sample 2, etc. All subsequently described data for these four samples come from the computer output in Appendix C.

The first question asked how the reading abilities of boys and girls compare in grades four through eight. The mean test scores of samples 1 and 2 were compared to answer this question. This information is given in Table 2. No obvious trends are evident and a two-tailed test showed that there were no significant differences between boys and girls on any of the tests.

Using only the Iowa Tests scores of samples 1 and 2, for grades four through eight, the annual growth rates

TABLE 1

NUMBER OF SUBJECTS IN EACH SAMPLE

Sample	Description	N
1	Boys having scores from fourth to eighth grade	81
2	Girls having scores from fourth to eighth grade	60
3	Boys entering after fourth grade	45
4	Girls entering after fourth grade	68
		254

TABLE 2

COMPARISON OF THE MEAN TEST SCORES OF THE BOYS AND GIRLS IN THE LONGITUDINAL STUDY IN GRADES FOUR THROUGH EIGHT

Test	Grade	Mean test scores		
		Boys	Girls	Difference[a]
Iowa Tests of Basic Skills (grade equivalent)				
Comprehension	4	4.58	4.64	-.06
Vocabulary	4	4.53	4.42	.11
Comprehension	5	5.82	5.54	.28
Vocabulary	5	5.89	5.55	.34
Comprehension	6	6.29	6.57	-.28
Vocabulary	6	6.55	6.54	.01
Comprehension	7	7.56	7.53	.03
Vocabulary	7	7.85	7.67	.18
Comprehension	8	8.72	8.87	-.15
Vocabulary	8	8.98	8.95	.03
California Reading Test (grade equivalent)				
Comprehension	8	8.9	9.3	-.4
Vocabulary	8	9.1	9.3	-.2
Cloze Test (raw score)	8	18.0	17.6	.4

[a]None of these differences are significant at the .05 level.

for each sample were determined. For each mean score in grades five through eight, the corresponding score for the previous year was subtracted to calculate the amount of growth in vocabulary and comprehension that year. This information is recorded in Table 3. The girls and boys had similar average annual growth rates, but the boys were more sporadic. The boys always remained on grade level even though there was a big drop in their growth rate in grade five. The drop was compensated for in grades four and six by above-average growth rates.

With a longitudinal study, correlations between tests can meaningfully be studied. The measure of correlation used for samples 1 and 2 was the Pearson product-moment correlation coefficient. The matrices of correlation coefficients between the 13 tests are given in Appendix C. Table 4 summarizes the information presented in the correlation matrices. The boys were more consistent in their testing, having an average correlation coefficient of .74, when all the reading tests and cloze tests were averaged.

The girls' average correlation coefficient is .64, with a much wider range, dipping as low as .30. Table 4 gives the mean correlation coefficients between the cloze test and the other eighth grade tests. It also gives the mean correlation coefficients between the eighth grade

TABLE 3

ANNUAL GROWTH RATES IN READING OF THE BOYS AND GIRLS IN THE LONGITUDINAL STUDY IN GRADES FOUR THROUGH EIGHT

Iowa test scores compared[a]	Annual growth of mean test scores		
	Boys	Girls	Difference
Fourth grade to fifth grade comprehension	1.24	.90	.34
Fourth grade to fifth grade vocabulary	1.36	1.13	.23
Fifth grade to sixth grade comprehension	.47	1.03	-.56
Fifth grade to sixth grade vocabulary	.66	.99	-.33
Sixth grade to seventh grade comprehension	1.27	.96	.31
Sixth grade to seventh grade vocabulary	1.30	1.13	.17
Seventh grade to eighth grade comprehension	1.16	1.34	-.18
Seventh grade to eighth grade vocabulary	1.13	1.28	-.15
Average	1.08	1.10	

[a]All tests given in early Fall.

TABLE 4

COMPARISON OF TEST CORRELATION COEFFICIENTS FOR SAMPLES 1 AND 2[a]

Product-moment correlation coefficients	Sex	
	Boys	Girls
Mean for all test scores	.74	.64
Range for all test scores	.55-.88	.30-.86
Mean correlations between:		
Cloze and eighth grade standardized test scores	.74	.61
Different eighth grade standardized test scores	.76	.64

[a]Refer to Appendix C for specific correlations.

standardized tests. Again, the boys had higher correlations than the girls. The correlations between the cloze tests and the eighth grade standardized tests tend to be lower than the correlations between just the eighth grade standardized tests. Generally, the cloze test correlates better with the Iowa Tests of Basic Skills in eighth grade than the California Reading Test.

The fourth question dealt with comparing the means of test scores for samples 1 and 3, and 2 and 4. Table 5 gives this information. There are significant differences between the boys entering in fifth grade and later, and those boys having been in South Brunswick from fourth to eighth grade. The latter group was consistently superior in reading ability. The girls entering were generally better readers than those girls in South Brunswick from fourth to eighth grade, but not significantly so.

Finding the reading scores of entering boys inferior and the scores of the entering girls superior to those of their South Brunswick counterparts stimulated a direct comparison between the entering boys and girls. Samples 3 and 4, containing all the students who entered after fourth grade, are compared in Table 6. There were significant differences, favoring the girls.

The computer output also included histograms showing the test score distributions for each of the four

TABLE 5

COMPARISON OF TEST SCORES OF STUDENTS LIVING IN SOUTH BRUNSWICK IN FOURTH GRADE WITH THOSE ENTERING LATER

		Mean test scores[a]								
		Boys					Girls			
Test	Grade	Sample 1	N	Sample 3	N	Difference	Sample 2	N	Sample 4	N	Difference
Iowa Tests of Basic Skills											
Comprehension	5	5.82	72	4.99	21	.83**	5.54	57	5.96	20	-.42
Vocabulary	5	5.89	72	5.37	21	.52	5.55	57	5.88	20	-.33
Comprehension	6	6.29	76	5.38	24	.91*	6.57	57	6.67	27	-.10
Vocabulary	6	6.55	76	5.74	24	.81*	6.54	57	6.66	27	-.12
Comprehension	7	7.56	79	6.79	38	.77*	7.53	60	7.96	52	-.43
Vocabulary	7	7.85	79	7.29	38	.56	7.67	60	7.81	52	-.14
Comprehension	8	8.72	78	8.02	45	.70	8.37	57	8.97	68	-.10
Vocabulary	8	8.98	78	8.23	45	.75*	8.95	57	8.95	68	-.00
California Reading Test											
Comprehension	8	8.9	72	8.4	44	.05	9.3	55	9.2	58	.10
Vocabulary	8	9.1	72	8.9	44	.02	9.3	55	9.3	58	.00

*Significant at the .05 level.

**Significant at the .01 level.

[a]All scores reported in grade level scores.

TABLE 6

COMPARISON OF THE MEAN TEST SCORES OF THE BOYS AND GIRLS ENTERING AFTER GRADE FOUR

Tests	Grade	Mean test scores		
		Boys	Girls	Difference
Iowa Tests of Basic Skills (grade level equivalent)				
Comprehension	5	4.99	5.96	-.97*
Vocabulary	5	5.37	5.88	-.51
Comprehension	6	5.38	6.67	-1.29*
Vocabulary	6	5.74	6.66	-.92
Comprehension	7	6.79	7.96	-1.17**
Vocabulary	7	7.29	7.81	-.52
Comprehension	8	8.02	8.97	-.95*
Vocabulary	8	8.23	8.95	-.72
California Reading Test (grade level equivalent)				
Comprehension	8	8.4	9.2	-.8
Vocabulary	8	8.9	9.3	-.4
Cloze Test (raw score)	8	17.9	18.2	-.3

*Significant at the .05 level.

**Significant at the .01 level.

samples on all ten Iowa tests. These histograms revealed no gross abnormalities in the distributions. It can be assumed then that the distributions were relatively normal.

CHAPTER V

SUMMARY AND CONCLUSIONS

The purpose of this study was to determine sex differences in reading achievement and growth patterns in a sample of students studied from fourth grade through eighth grade. The Iowa Tests of Basic Skills, the California Reading Test, and an informal cloze test were used as measuring devices.

All 263 eighth grade students at Crossroads Junior High School in South Brunswick, New Jersey, in the 1968-69 school year participated in the study. Only those students who were in South Brunswick for the five-year period took part in the actual longitudinal study.

Sex differences were not evident between the boys and girls in the longitudinal study. There were no significant differences at the .05 level between the mean test scores of the boys and the mean test scores of the girls. Eight of the thirteen differences favored the boys.

Although the average annual growth rates over the five-year period for the boys and girls were similar (1.08 and 1.10, respectively), the boys' pattern of growth was more sporadic. A large drop in reading growth for the

boys occurred in fifth grade. The drop was compensated for by unusually large gains in reading in the fourth and sixth grades.

A comparison of the test correlation coefficients of the boys and girls in the longitudinal study showed that the boys consistently had higher correlations. The average product-moment correlation for all the test scores of the boys was .74, but only .64 for the girls. The girls also had a wider range, .30 to .86, as opposed to the boys' range of .55 to .88.

Comparing students entering the school system after fourth grade to the students in the longitudinal study revealed that the boys in the former group were significantly poorer readers than the boys already in South Brunswick. The entering girls tended to be better readers than the girls in the longitudinal study, but not significantly so. A direct comparison between the entering boys and girls showed the latter to be significantly better readers.

The cloze test was used in this study to determine whether sex differences were present, using an unstandardized test, and also to see how the cloze test correlated with the other two standardized tests. The mean test scores for the cloze test for the boys and girls in the longitudinal study revealed no sex differences. However,

sex differences did appear when considering the correlation coefficients between the cloze test and the other eighth grade tests. The correlation coefficients for the boys were consistently higher than for the girls. Generally, the cloze test did not correlate well with the other eighth grade tests. It did correlate better with the Iowa Tests of Basic Skills than the California Reading Test.

Discussion

It is difficult to relate this longitudinal study to previously mentioned studies because the principal finding in the previous studies, the sex gap, was not observed. The only sex differences detected were the more sporadic annual growth rates of the boys, with their drop in achievement in fifth grade, and the higher correlations between the test scores of the boys. Neither of these observations were anticipated by previous studies. Since the Iowa Tests of Basic Skills does not discriminate between the sexes, it can be assumed that there was an actual drop in achievement for the boys in fifth grade. It can also be assumed that the boys were more consistent than the girls in their testing because their correlations between tests were higher.

When considering samples 3 and 4, students entering South Brunswick in fifth grade and later, sex

differences were evident. There were significant differences between the boys and girls entering the township's schools. The anticipated reading superiority of the girls was observed here. Also, it is interesting that the boys entering after fourth grade were significantly inferior to those having been in South Brunswick from fourth grade on. Unfortunately, it was impossible to carry out a longitudinal study with samples 3 and 4, because there were too few students with similar histories.

A glance at the recent history of the South Brunswick School System reveals some possible factors which might have contributed to the elimination of sex differences in the town's elementary schools. The ungraded system was started on a trial basis in one elementary school when these eighth graders were starting fourth grade. About 18 of the eighth graders were selected for the study. Approximately 10 more children in this study were introduced to the ungraded system in fifth grade. A few more students were involved in the still experimental program in sixth grade. All students encountered the ungraded system when they entered seventh grade at Crossroads Junior High School, new that year. None of these students were initially taught to read under the ungraded system, but a small percentage of children were exposed to the system in grades four through six, and all encountered

it in grades seven and eight. Therefore, it seems evident that the ungraded system could not be responsible for eliminating sex differences in reading ability.

However, South Brunswick had encouraged the individualization of instruction long before the actual experiment with the ungraded system was started. The multitext approach to reading instruction was in existence during the first three years these students were in school, as well as following years. Teachers were strongly encouraged to use different books and instructional materials, as well as different methods, to meet the needs of individual children. Poor readers were identified early and supplemental instruction was provided for many of them. Children with severe reading disabilities were often placed in special classes.

The following factors may have contributed to the absence of sex differences in the longitudinal study: a strong emphasis on individualization of instruction and a flexible teaching situation, early remediation or possible placement of children with severe disabilities in special classes, and finally, the ungraded system. The fact that children coming from more traditional schools entering South Brunswick exhibited the expected sex differences suggests that environmental factors might be operating. Preston's (1962) study strongly supports this point of

view. He compared the reading achievement of American and German children, and found American girls and German boys to be the better readers. In Germany, Preston noted, reading is cultivated as a masculine activity with many male teachers on the elementary level. Perhaps, then, any physiological handicaps boys may have, such as later maturation or shorter attention spans, may be compensated for in the classroom environment.

Three previously cited studies (Bormuth, 1965; Jenkinson, 1957; Ruddell, 1966) suggested that there is a high correlation between scores on cloze tests and scores on standardized tests of reading comprehension. A high correlation was not consistently evident in the present study. Sample 1 was the only sample that revealed a correlation of .74 between both eighth grade standardized reading comprehension tests and the cloze test. The other three samples exhibited low correlations, including correlations as low as .39 for sample 2, and .38 for sample 3, between the cloze test and the California Reading Test. The cloze test correlated better with the Iowa Tests of Basic Skills than the California Reading Test. It is possible that the comprehension sections on these two tests are not measuring the same thing. The skills measured by the cloze test may be more similar to those measured by the Iowa Tests of Basic Skills than those measured by the California Reading Test.

Conclusions

This study led the author to the following conclusions:

1. The girls and boys in South Brunswick from fourth grade to eighth grade exhibited no significant sex differences in reading ability.

2. Although the boys and girls had similar average reading growth rates, the former grew more sporadically.

3. Product-moment correlations between tests showed the boys to be more consistent than the girls.

4. The students entering South Brunswick after fourth grade exhibited the expected sex differences, favoring the girls. The boys entering later were significantly inferior in reading ability to both the boys already in South Brunswick and to the girls also entering after fourth grade.

5. The cloze test did not correlate well with the other eighth grade standardized tests. It did correlate better with the Iowa Tests of Basic Skills than the California Reading Test.

Suggestions for Further Research

Even though the topic of sex differences in reading ability has been researched for many years, there are still some unanswered questions. The question of whether or not girls have an inherent advantage in learning to

read or whether this advantage has been built into our school systems has not been answered. More experimentation is needed to see if different grouping will prove to be helpful for teaching boys to read, such as the ungraded system, the Joplin plan, or individualized reading. More research similar to that done by Stanchfield would be most beneficial because its purpose is to determine constructive measures that can be taken to provide a better learning environment for boys. Publishing companies could be very useful in this area by including more high interest, adventure stories in their basal readers. Many other suggestions have been offered by educators as possible steps toward closing any gap that may exist between boys' and girls' reading abilities. Such suggestions include delaying formal reading instruction for those not ready for it, planning in-service programs for teachers to sensitize them to sex differences and individualization of instruction, and encouraging more men to enter the field of elementary education. Additional research is needed to test these possible solutions. Longitudinal studies are needed to understand more thoroughly the evolving patterns of sex differences.

Because the teaching of reading is of major concern to educators today, the frequent disparity between girls' and boys' reading ability should also be of major

concern. The fact remains that in some schools sex differences are not evident. This fact should provide the needed incentive for further research into the reading development of boys and girls.

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APPENDIX A

CLOZE TEST INSTRUCTIONS

AND SAMPLE OF TEST

January 20, 1969

Dear English teachers,

You will find in your mailbox the forms for the cloze test to be administered to your eighth grade students. The directions are to tell them to fill in the blanks with the word they feel is most appropriate or fitting. Advise the students they may have to read ahead sometimes to get the answer. If they are having trouble with a particular word, read on, and then go back. Allow them as much time as they need to finish. The test should not take longer than a half hour. Please check that everyone has written his name on the paper.

Use sentence one as an example. Fill in the first two blanks in this sentence with the students, so they understand completely what to do. ("In the snowflake we see the infinitely complex architecture of nature.")

Would you please return these to me sometime this week. If you have any questions, don't hesitate to ask me for any clarification. The results should be available for your use within a week. Thank you for your assistance.

Sincerely,

Karen S. Carlson

Name:

Snow and Snowflakes

In the Snowflake we_____the infinitely complex architecture_____nature. The form is_____that of a hexagonal_____, but each one is_____unique masterpiece.

Snow is_____actually white. It just_____ white. Since it is_____water, it is colorless. _____ rays are reflected and_____when they strike the_____of tha myriad snow_____. The transparent ice of_____ flake appears white because_____has so many of_____ reflecting surfaces.

In certain_____parts of the earth,_____can sometimes see red_____. At the North and_____Poles, for instance. High_ ___the Alps, too, climbers_____ sometimes startled to come_____a dark red landscape. _____is caused by microscopic_____plants that grow on _____surface of the snow. _____snowfalls have been reported_____Virginia. They are produced_____carbon particles from factory_____combine with the falling _____. Chicago had a brown_____in 1947, caused by _____dust mixture. When pollen_____pine and cypress trees_____with snow, you see_____snowfalls. And there have_____reports of blue and_____ones.

Fresh snow looks_____and fluffy. Scoop up_____ handful and it seems_____nothing. A cubic foot_____

weigh only six pounds. _____snow-drift can be_____ light--one part ice_____and 89 parts air. _____when snow is compressed--_____your roof, or in_____crevasses--where it has_____hardened by wind and_____, it can weigh up_____30 pounds a cubic foot. It can crush buildings and hurtle into mountain valleys in massive, deadly avalanches.

APPENDIX B

LISTING OF MAIN COMPUTER PROGRAM

```
C     KARSY
C     KAREN'S STATISTICAL ANALYSIS PROGRAM
C
C
C     DATA CARDS HAVE FOLLOWING FORMAT:
C             COLUMNS 1-8  NAME OF STUDENT
C             COLUMN 9 STUDENT'S SECTION
C             COLUMN 10 SEX OF STUDENT
C             COLUMNS 19 - 22 SCORE 1
C               AND SO FORTH UNTIL
C             COLUMNS 67 - 70 SCORE 13
C
C             ALL SCORES SHOULD BE WRITTEN WITH DECIMAL POINTS
C             WHEN A SCORE IS MISSING, LEAVE ITS COLUMNS BLANK
C             SAMPLE CARD
C
      DIMENSION SCORE(13),NAME(8),X(7500),CODE(13),
                                  XBAR(13),STD(13),
     1 SKEW(13),CURT(13),N(169),Z(169),B(169),S(169),P(169)
      DIMENSION TITLE(20)
      DIMENSION Y(7500)
      REAL NAME
      INTEGER SEX
C     INITIALIZE A FEW THINGS
      DIMENSION JIMSY(169)
      DIMENSION TITLES(13)
    2 FORMAT(80A1)
      READ(5,3) TITLES
    3 FORMAT(18X,13(1X,A3))
      NO = 500
      M = 13
      MM = M*M
      MNO = M*NO
      DO 4 I=1,M
    4 CODE(I) = 0.
      NSAMP = 0
    5 CONTINUE
      NSAMP = NSAMP + 1
```

```
      READ(5,1000) TITLE
 1000 FORMAT(20A4)
      NUMBER = 0
      DO 10 I = 1,N
      XBAR(I) = 0.
      STD(I) = 0.
      SKEW(I) = 0.
   10 CURT(I) = 0.
      DO 11 J=1,NB
      R(J) = 0.
      N(J) = 0
      A(J) = 0.
      B(J) = 0.
   11 S(J) = 0.
      DO 12 J=1,NNO
      Y(J) = 0.
   12 X(J) = 0.
      WRITE(6,20)
   20 FORMAT(1H1,'DATA CARDS SELECTED AND USED FOR ANALYSIS')
      WRITE(6,1001) ITITL
 1001 FORMAT(1HO,20A4)
      DO 100 II = 1,NO
      READ(5,30) NAME,PSYCH,SEX,SCORE
   30 FORMAT(3A1,I1,I1,8X,13F4.1)
      DO 32 I=1,10
      IF(SCORE(I).EQ.0.) GO TO 32
      SCORE(I) = SCORE(I)/10.
   32 CONTINUE
      IF(SEX.EQ.8) GO TO 101
      IF(SEX.EQ.9) GO TO 100
      NUMBER = NUMBER + 1
      WRITE(6,40) NUMBER,NAME,PSYCH,SEX,SCORE
   40 FORMAT(1H ,I3,3A1,2I2,13F5.1)
      DO 50 I=1,N
      NU = (I-1)*NO + NUMBER
   50 X(NU) = SCORE(I)
  100 CONTINUE
  101 CONTINUE
C     COMPACT THE DATA ARRAY
      DO 150 I=1,NUMBER
      DO 150 J=1,N
      NU = (J-1)*NO + I
      NUNU = (J-1)*NUMBER + I
  150 Y(NUNU) = X(NU)
  200 WRITE(6,210) NSAMP
  210 FORMAT(1H1,/////,1H ,10X,25X,'TABLE',I2)
      WRITE(6,214)
  214 FORMAT(1HO,10X,25X,'DATA FOR')
```

```
      WRITE(6,212) TITLE
  212 FORMAT(1H ,10X,20A4)
      WRITE(6,213) NSAMP
  213 FORMAT(1HO,10X,25X,'SAMPLE',I2)
      WRITE(6,211)
  211 FORMAT(1HO,10X,31X,'MEAN   STD.DEV.   NUMBER  ')
      CALL MISF('NUMBER,N,Y,CODE,XBAR,STD,SKEW,CURT,P,V,A,B,S,IER)
      DO 300 I=1,M
      III = (I**2 - I)/2 + I
      XDEV = 0.
      IF(N(III).EQ.0) GO TO 220
      AN = N(III)
      XDEV = STD(I)/(SQRT(AN))
  220 CONTINUE
      IF(I.EQ.1) WRITE(6,250)
  250 FORMAT(1H ,12X,'IOWA TESTS OF BASIC SKILLS',
     1  /1H ,12X,'(GRADE EQUIVALENTS)')
      IF(I.EQ.11) WRITE(6,251)
  251 FORMAT(1H ,12X,'CALIFORNIA READING TEST',
     1  /1H ,12X,'(RAW SCORES)')
      IF(I.EQ.13) WRITE(6,252)
  252 FORMAT(1H ,12X,'CLOZE TEST',
     1  /1H ,12X,'(RAW SCORES)')
  300 WRITE(6,310) TITLES(I),XBAR(I),STD(I),N(III)
  310 FORMAT(1H ,10X,13X,A3,14X,F5.2,4X,F5.2,6X,I3)
      WRITE(6,320)
  320 FORMAT(///1H ,25X,'PRODUCT MOMENT CORRELATIONS')
      WRITE(6,335) (TITLES(I),I=1,12)
  335 FORMAT(1HO,12X,'TEST',12(1X,A3))
      DO 325 I=2,M
      J = (I**I - I)/2 + 1
      K = (I**I - I)/2 + I
      K = K - 1
      DO 326 L=J,K
      IF(R(L).LT..05.OR.R(L).GT.1.00) R(L) = 0.
  326 JIMSY(L) = 100.*R(L) + .5
  325 WRITE(6,330) TITLES(I), (JIMSY(L),L=J,K)
  330 FORMAT(1H ,13X,A3,12(' .',I2))
      GO TO 5
  400 CONTINUE
      STOP
      END
```

APPENDIX C

COMPUTED STATISTICS FOR EACH OF THE FOUR SAMPLES

TABLE 1

DATA FOR
BOYS IN LONGITUDINAL STUDY

SAMPLE 1

	MEAN	STD. DEV.	NUMBER
IOWA TESTS OF BASIC SKILLS (GRADE EQUIVALENTS)			
4CP	4.58	1.32	81
4TB	4.73	1.31	81
5CP	5.22	1.56	72
5TB	5.29	1.47	72
6CP	6.22	1.80	76
6TB	6.55	1.70	76
7CP	7.56	1.71	79
7TB	7.35	1.69	79
8CP	8.72	2.03	78
8TB	8.98	1.99	78
CALIFORNIA [illegible] TEST (RAW SCORES)			
CCP	54.08	16.87	72
CTB	43.71	10.91	72
CLOZE TEST (RAW SCORES)			
CTP	15.03	[illegible].22	68

PRODUCT MOMENT CORRELATIONS

TEST	4CP	4TB	5CP	5TB	6CP	6TB	7CP	7TB	8CP	8TB	CCP	CTB
4TB	.83	.										
5CP	.85	.79	.									
5TB	.80	.78	.85	.								
6CP	.74	.79	.76	.76	.							
6TB	.75	.85	.80	.83	.83	.						
7CP	.81	.73	.80	.70	.73	.74	.					
7TB	.78	.76	.80	.80	.72	.83	.84	.				
8CP	.82	.74	.83	.75	.79	.84	.84	.84	.			
8TB	.79	.77	.82	.82	.70	.83	.79	.88	.86	.		
CCP	.77	.69	.74	.69	.62	.77	.80	.78	.83	.79	.	
CTB	.62	.56	.63	.60	.55	.63	.67	.70	.65	[illegible]	.74	.
CTP	.70	.67	.66	.67	.59	.66	.70	.70	.74	.76	.74	.63

POOR ORIGINAL COPY - BEST AVAILABLE AT TIME FILMED

TABLE 2

DATA FOR
GIRLS IN LONGITUDINAL STUDY

SAMPLE 2

	MEAN	STD. DEV.	NUMBER
IOWA TESTS OF BASIC SKILLS (GRADE EQUIVALENTS)			
4CP	4.64	1.14	60
4VB	4.42	1.13	60
5CP	5.54	1.22	57
5VB	5.55	1.12	57
6CP	6.57	1.35	57
6VB	6.54	1.34	57
7CP	7.53	1.40	60
7VB	7.67	1.60	60
8CP	8.07	1.76	57
8VB	8.25	1.57	57
CALIFORNIA READING TEST (RAW SCORES)			
8CP	57.11	12.23	55
8VB	44.51	9.92	55
CLOZE TEST (RAW SCORES)			
8IZ	17.56	4.23	52

PRODUCT MOMENT CORRELATIONS

TEST	4CP	4VB	5CP	5VB	6CP	6VB	7CP	7VB	8CP	8VB	8CP	8VB
4VB	.76	.										
5CP	.66	.64	.									
5VB	.66	.65	.72	.								
6CP	.63	.63	.86	.73	.							
6VB	.68	.68	.66	.66	.69	.						
7CP	.71	.64	.78	.71	.79	.78	.					
7VB	.60	.68	.74	.81	.70	.78	.79	.				
8CP	.66	.62	.76	.64	.82	.69	.79	.74	.			
8VB	.60	.60	.65	.64	.68	.60	.72	.80	.79	.		
8CP	.32	.34	.47	.46	.51	.30	.44	.45	.53	.46	.	
8VB	.62	.57	.70	.67	.73	.64	.65	.71	.77	.75	.52	.
8IZ	.53	.47	.65	.69	.66	.59	.65	.65	.58	.49	.39	.72

TABLE 3

DATA FOR
BOYS ENTERING AFTER FOURTH GRADE

SAMPLE 3

	MEAN	STD. DEV.	NUMBER
IOWA TESTS OF BASIC SKILLS			
(GRADE EQUIVALENTS)			
4CP	0.0	*****	0
4VB	0.0	*****	0
5CP	4.99	1.06	21
5VB	5.37	1.19	21
6CP	5.38	1.53	24
6VB	5.74	1.69	24
7CP	6.79	1.54	38
7VB	7.29	1.46	38
8CP	8.02	2.04	45
8VB	8.23	2.04	45
CALIFORNIA READING TEST			
(RAW SCORES) CCP	50.00	16.11	44
CVB	42.61	11.36	44
CLOZE TEST			
(RAW SCORES)			
CLZ	17.88	4.77	43

PRODUCT MOMENT CORRELATIONS

TEST	4CP	4VB	5CP	5VB	6CP	6VB	7CP	7VB	8CP	8VB	CCP	CVB
4VB	.0	.										
5CP	.0	.0	.									
5VB	.0	.0	.72									
6CP	.0	.0	.69	.59	.							
6VB	.0	.0	.82	.77	.77	.						
7CP	.0	.0	.73	.70	.69	.50	.					
7VB	.0	.0	.81	.89	.70	.74	.77	.				
8CP	.0	.0	.62	.73	.44	.55	.61	.73	.			
8VB	.0	.0	.67	.84	.61	.75	.57	.85	.88	.		
CCP	.0	.0	.44	.68	.28	.32	.57	.65	.69	.61	.	
CVB	.0	.0	.67	.76	.46	.50	.63	.74	.70	.79	.82	.
CLZ	.0	.0	.44	.54	.46	.33	.57	.60	.59	.60	.38	.56

TABLE 4

DATA FOR
GIRLS ENTERING AFTER YOU TH GRADE

	SAMPLE 4 MEAN	STD. DEV.	NUMBER
IOWA TESTS OF BASIC SKILLS (GRADE EQUIVALENTS)			
4CP	0.0	*****	0
4VB	0.0	*****	0
5CP	5.96	1.55	20
5VB	5.88	1.57	20
6CP	6.67	2.04	27
6VB	6.66	1.89	27
7CP	7.96	1.64	52
7VB	7.81	1.90	52
8CP	8.97	1.91	68
8VB	8.95	1.96	68
CALIFORNIA READING TEST (RAW SCORES)			
CCP	55.55	15.74	58
CVB	44.53	10.33	58
CLOZE TEST (RAW SCORES)			
CLZ	18.19	5.13	62

PRODUCT MOMENT CORRELATIONS

TEST	4CP	4VB	5CP	5VB	6CP	6VB	7CP	7VB	8CP	8VB	CCP	CVB
4VB	.0	.										
5CP	.0	.0	.									
5VB	.0	.0	.82	.								
6CP	.0	.0	.88	.83	.							
6VB	.0	.0	.81	.85	.91	.						
7CP	.0	.0	.93	.87	.87	.81	.					
7VB	.0	.0	.84	.93	.83	.87	.83	.				
8CP	.0	.0	.92	.89	.75	.73	.90	.88	.			
8VB	.0	.0	.82	.90	.77	.80	.81	.91	.86	.		
CCP	.0	.0	.77	.75	.51	.51	.72	.75	.79	.70	.	
CVB	.0	.0	.75	.75	.56	.50	.66	.73	.71	.63	.79	.
CLZ	.0	.0	.76	.74	.62	.59	.64	.67	.69	.66	.43	.45